

Do Promise Programs Reduce Student Loans? Evidence from Tennessee Promise

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Abstract

As college promise programs proliferate across the United States with noted intentions to promote access through increased affordability, it is necessary to understand the relationship between these programs and other forms of financial aid, including loans. Using federal, state, and program-level data, we leverage a natural experiment to estimate causal impacts of the nation's first statewide program (Tennessee Promise) on students' borrowing behaviors in a community college system. In the difference-in-differences framework, we find robust evidence to suggest Tennessee Promise reduced the percent of first-time, full-time students borrowing by 8-10 percentage points on average after implementation—an over 40% decline—and reduced the average community college cohort loan by \$230-360 (nearly 32%). While consistent with prior work on grant aid, these findings are among the first to explore promise students' financial outcomes. We discuss these results in relation to Tennessee Promise's programmatic features and identify important implications for policy and research.

Keywords: Grants, Higher education, Loans, Promise programs, State and federal aid, Student financial aid

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As college promise programs proliferate across the United States with noted intentions to promote access through increased affordability, it is necessary to understand the relationship between these programs and other forms of financial aid, including loans. Using federal, state, and program-level data, we leverage a natural experiment to estimate causal impacts of the nation's first statewide program (Tennessee Promise) on students' borrowing behaviors in a community college system. In the difference-in-differences framework, we find robust evidence to suggest Tennessee Promise reduced the percent of first-time, full-time students borrowing by 8-10 percentage points on average after implementation—an over 40% decline—and reduced the average community college cohort loan by \$230-360 (nearly 32%). While consistent with prior work on grant aid, these findings are among the first to explore promise students' financial outcomes. We discuss these results in relation to Tennessee Promise's programmatic features and identify important implications for policy and research.

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Introduction

A diverse body of evidence consistently suggests that college pays. The individual and societal returns to a postsecondary credential outweigh its costs across the lifetime, and, not only is a degree associated with higher earnings, but it is now central to upward social mobility (Chetty et al., 2017; Ma et al., 2019). Despite this evidence, not all students enroll in college. Many factors contribute to this phenomenon, including affordability constraints (Long & Riley, 2007). As tuition increases vastly outpace improvements to grant aid, many students rely on loans to pay college costs (Scott-Clayton, 2018). While some choose to attend a community college instead of a four-year institution given lower sticker prices and greater purchasing power of grant aid, borrowing is still pervasive in the two-year sector (Belfield & Bailey, 2011; González Canché, 2016, 2019). In the 2016 National Postsecondary Student Aid Study, 36% of undergraduates at public two-year institutions reported some student loan debt (down from 41% in 2012; Ma & Baum, 2016). While community college students are less likely to borrow and accrue lower loan balances than their four-year peers, they are more than twice as likely to default—with roughly only two-thirds entering repayment within five years (College Board, 2019). Two additional features of community colleges make borrowing especially problematic: Two-year institutions have low completion rates (increasing the likelihood of “debt but no degree”) and concentrate enrollments of low-income, Black, and other racial-minority students (groups disproportionately harmed by loans; Gross et al., 2010; Miller, 2019; U.S. Department of Education, 2019). For these reasons, promoting college access through increased affordability has been of particular interest to state governments (Delaney, 2014; Doyle, 2012).

As states face growing workforce needs, policymakers have sought to increase college access and affordability in many ways, including targeted information and broader access to

grant aid (Carnevale et al., 2013; Tierney & Venegas, 2009). A notable development spanning each of these realms has been the proliferation of place-based (or “promise”) scholarships that predominantly target community colleges. Nearly 300 such programs operate across the nation today (Perna & Leigh, 2018). By design, promise programs have the potential to reduce information constraints and financial barriers, thereby increasing college enrollment and degree attainment (Dynarski et al., forthcoming). While these outcomes could be expected, there is substantial variation in programmatic goals, eligibility, and awards. As such, research on promise programs has been varied, though most studies have focused on students’ enrollment and persistence in higher education (Swanson et al., 2020). In the affordability arena, promise programs directly increase affordability by reducing eligible students’ costs of attendance. This happens through the introduction of new grant aid or through the replacement of other sources of financial aid (e.g., loans) with grant aid. Either reality suggests promise scholarships hold the potential to reduce the prevalence and intensity of recipients’ borrowing behaviors. Even if reducing borrowing is a secondary outcome of promise programs—compared to increasing enrollment or attainment—student loans have direct impacts on students’ educational outcomes, particularly at community colleges (Dowd & Coury, 2006; McKinney & Burrridge, 2015). Despite this expected link, no study to our knowledge has estimated the effect of a promise program on students’ loan outcomes. Our study seeks to fill this gap by linking promise program adoption to changes in borrowing behaviors.

We leverage a natural experiment in Tennessee—the adoption of the first statewide promise scholarship, Tennessee Promise—to estimate causal effects on borrowing in community colleges. Using a difference-in-differences strategy, we document changes in the percent of first-time, full-time (FTFT) students who borrow from any loan program (i.e., federal, state,

institutional, or private sources) and the average loan borrowed from all sources by the entering financial aid cohort.¹ While this is the first study to causally link a promise program to student loan behaviors, our work contributes to a growing body of evidence considering the interaction of grant aid with other sources of aid and to a larger body of literature on the effects of promise programs on students' outcomes. Our findings also have salient implications for public policy as the costs and benefits of promise programs are debated at the federal, state, and local levels (Billings, 2018).

Literature Review

Promise program evaluations have proliferated in the last five years alone, causally linking diverse programs to a variety of outcomes. One of the earliest was an evaluation of Knox Achieves, a local, last-dollar scholarship program that began in 2009 and led to the creation of Tennessee Promise in 2015.² Carruthers and Fox (2016) found Knox Achieves increased the likelihood of immediate college enrollment by 3.5-4.0 percentage points, with evidence also supporting increased high school graduation rates and college-credit accumulation. More recently, Dynarski et al. (forthcoming) found receipt of the place-based High Achieving Involved Leader scholarship led students to apply and enroll at selective institutions at rates more than double their peers. Across other evaluations, researchers have documented increased enrollment and persistence rates, four-year to two-year enrollment diversion, and increased degree completion (Bartik et al., 2021; Carruthers et al., 2018; Gurantz, 2020). Others have also observed increases in student access and retention, as well as improvements in community and workforce development outcomes (Bifulco et al., 2019; Miller-Adams, 2015; Pluhta & Penny,

¹ The financial aid cohort is the number of FTFT degree/certificate-seeking undergraduate students enrolled at an institution as of the official fall reporting date.

² Grant aid from "last-dollar" programs is applied after all other grant aid (e.g., Pell Grants plus any other merit- or need-based award) has been applied.

2013; Sohn et al., 2017). Given their political popularity, however, the adoption and growth of these place-based programs has rapidly outpaced evaluations of their effects, leaving many outcomes—like borrowing—unexplored in the literature (Page et al., 2019).

A growing body of evidence suggests grant aid is an effective mechanism to reduce student loans. Marx and Turner (2018) considered the effect of the Pell Grant on student borrowing and found that every \$1.00 of grant aid reduced students' average first-year loan by \$0.43 over all students but reduced borrowers' first-year loans by \$1.80. Further, work by Denning et al. (2019) found the amount borrowed in a student's first year fell by \$620 in response to a \$520 increase in grant aid. This crowding out (also above 100%) was estimated to reach 157% for students who likely would have borrowed without access to the program. More recently, Evans and Nguyen (2019) used Pell eligibility to find that an average increase of \$1,100 in grant aid reduced borrowing by an average of \$300-400 over all students at four-year institutions, and separate studies on the introduction of the Gates Millennium Scholarship and the non-need-based West Virginia PROMISE found that each significantly reduced recipients' student loan burdens (DesJardins & McCall, 2014; Scott-Clayton, 2011).³ Finally, Chapman (2016) documented that qualification for a state merit aid program reduced students' cumulative loan burden by \$7,200 on average. These works consistently suggest that grant aid from a variety of sources crowds out student loans—particularly to a high degree for would-be borrowers. In the context of promise programs, grant aid from these sources may similarly reduce the need to borrow overall and the extent of any subsequent borrowing. The introduction of a free-college program is, at its core, the introduction of a new and (commonly) large-scale grant program with

³ Despite its name, West Virginia PROMISE is not a traditional, place-based scholarship as defined in existing literature. It is a merit-aid program with applicability at public and private, two- and four-year institutions, like the HOPE programs in Georgia and Tennessee.

near-universal eligibility; a source of aid students could use wholly in place of loans or to reduce financial gaps that would be covered by (larger) loans. This reality would lead to documentable reductions in the percent of students borrowing and in the average amount of any loans that are originated. Indeed, rational choice theory suggest students should prefer grant aid in place of loans, and, if a promise program eliminates a gap between tuition and fee costs and existing financial aid, borrowing would be sharply reduced (Cadena & Keys, 2013). In this sense, promise scholarships—particularly from last-dollar programs that cover up to the full cost of tuition and fees like Tennessee Promise—may serve as effective replacements for loans, providing additional grants while simultaneously reducing students’ loan burdens; outcomes both associated with a variety of other positive outcomes (Kim, 2007).

To consider this interaction between promise programs and student borrowing, we draw from Chen’s (2008) integrated theory of financial aid and posit that a combination of student, financial, and institutional factors influence borrowing at the community college level and help explain the relationship between promise programs and borrowing outcomes. Chen’s (2008) framework highlights the complex relationship between financial aid and a host of student outcomes, underscoring the role that many factors play in this relationship, leading prior works on student borrowing in the community college sector to similarly adopt this framework (McKinney & Burrige, 2015). On the student front, prior work in Tennessee showed that enrollment gains brought about by Tennessee Promise were largest among Black students (Nguyen, 2020), and descriptive evidence on student borrowing points to differences in borrowing along dimensions of students’ race and socioeconomic status (Hillman, 2015). Though compositional changes in Tennessee’s community-college cohorts were quasi-experimentally estimated to be small and fade out beginning in the second year, changing

preferences for loans or levels of debt aversion among students may help explain possible changes in borrowing outcomes (Boatman et al., 2017). On the financial front, students borrow to cover direct and indirect costs of attendance, and student loans serve as a bridge to cover gaps between total cost and existing or expected resources (i.e., financial need). Thus, financial need and related borrowing decisions can be directly driven by changes in resources. As noted, promise programs may mechanically reduce the need to borrow (or the extent of borrowing) by increasing available resources and reducing or eliminating financial need. Finally, on the institutional front, in addition to showing that grant aid can displace loans, Marx and Turner (2018) observe that institutional practices around financial aid packaging can have large impacts on borrowing and may moderate the extent of this displacement. In this light, in addition to a mechanical reduction or elimination of the need to borrow, community colleges may reduce proactive loan offering or packaging practices in light of new grant aid (i.e., from Pell or promise programs), further reducing borrowing.

Considering the replacement of student loans in whole or in part with grant aid via promise programs is important for many reasons. First, promise scholarships are a unique type of grant aid. For last-dollar programs, eligible students' award amounts depend entirely upon receipt of other grant aid. While aid programs that vary levels of treatment often produce heterogeneous effects (Dynarski & Scott-Clayton, 2013), promise programs of this nature treat all recipients the same by eliminating their mandatory tuition and fee expenses. Whether they apply \$1 or \$10,000 of grant aid, last-dollar programs are agnostic to the level and source(s) of other aid and to the amount of total college costs. This could be contrasted with Pell or other programs where awards are capped or contingent upon costs, or where students are eligible to receive disbursements of remaining funds. Second, it could be expected that last-dollar programs

interact differently with other aid programs than traditional grants. While merit-based aid has been shown to crowd out need-based aid, for example, this should not be expected of a last-dollar program (Doyle, 2010). That is, the last-dollar funding turns on in the presence *and* absence of other grant aid, so long as a financial gap remains, and is not used to determine the eligibility or receipt of other aid. Finally, many promise programs, like their need- or merit-based peers, have enrollment requirements. For example, Tennessee Promise requires students to maintain continuous and full-time (12 credits) enrollment. This requirement could *increase* borrowing behaviors if a requirement to enroll in more hours reduces time available for labor-market participation. Yet, if new sources of grant aid provide nominal support above and beyond lost wages, students may dedicate more time to academics—increasing credit accumulation, performance, and degree attainment—without also needing to borrow. In fact, Evans and Nguyen (2019) found more grant aid reduced weekly job hours and associated earnings but to nominally lower levels than the aid award. To date, however, this possible outcome of promise programs has not been explored. Each of these unique features and possible outcomes begs further research into the effects of promise programs on students' financial outcomes.

Tennessee Promise

In academic year 2015-16, Tennessee Promise (hereafter “Promise”) became the nation’s first statewide promise program. Promise is a last-dollar program, covering 2 years (or 5 semesters) of tuition and mandatory fees, available to recent high school graduates who pursue an associate degree or technical certificate at the state’s 13 public community colleges or 27

colleges of applied technology.^{4,5} For students who received Promise scholarships after all other grant aid was exhausted, the average annual award was approximately \$2,021 across the first three cohorts.⁶ To qualify, students must complete a short application and file the FAFSA. To maintain eligibility, students complete 8 hours of community service per term and maintain satisfactory academic progress (2.0 GPA) and continuous, full-time (12 credits) enrollment. Promise is administratively operated by the Tennessee Student Assistance Corporation and utilizes foundation partners to coordinate community service functions and a mentorship program.⁷ Though the statewide program began in 2015-16, it was preceded by a number of local, county-based programs. The first of these local programs, Knox Achieves, began six years prior in fall 2009. From 2009 until 2011, 2 community colleges had some promise students within each academic year and 8 had Promise students by 2014, though these students only represented 13.9% of all FTFT students.⁸

According to data published by the Tennessee Higher Education Commission (THEC; 2019), Promise fundamentally changed higher education in the state. In its first year, over 80% of public and private high school students applied for Promise, and the college-going rate descriptively increased 5.9 percentage points (THEC, 2019). Of the 2015 high school cohort, nearly 22% enrolled in higher education as Promise students, and the size of subsequent cohorts

⁴ Tennessee operates a merit-based HOPE scholarship (established in 2004) that provides a base award of \$3,000 for first-year community college students and a need-based Tennessee Student Assistance Award (established in 1976) that provides a base award of \$1,300 per year.

⁵ Some private institutions and two public universities are also eligible so long as a student is exclusively enrolled in a sub-baccalaureate program. While Promise students may attend TCATs, we exclude them from this analysis because borrowing was already exceptionally rare at TCATs and an additional TCAT scholarship covers up to students' cost of attendance. Future work with student-unit data should consider the effect of Promise at TCATs.

⁶ This amount is slightly less than half of the average tuition and fees in the community college sector of \$4,335 (THEC, 2018). Due to the last-dollar design of the program, the difference between the average award and price can be attributed to students who received grant aid from other sources (e.g., Pell or state need- or merit-based aid).

⁷ Tennessee Achieves ("tnAchieves") is the state's primary foundation partner, formerly serving as the leader for Knox Achieves.

⁸ For a detailed view of the state's staggered implementation of promise programs, see Table A1.

has increased steadily. Overall, first-time freshman enrollment in community colleges grew 27.7% in the first year with notable increases in FTFT enrollment, yet quasi-experimental evidence suggests the enrollment increase attributable to Promise may be closer to 40% (Nguyen, 2020; THEC, 2019). Early indicators of Promise students' outcomes are also reported to be positive, with students descriptively attempting more credit hours and being retained at higher rates than their non-Promise peers (THEC, 2019). Further, recent evidence by Carruthers et al. (2018) suggests Promise students are more likely to earn a postsecondary credential than their non-Promise peers; 36.3% of the first cohort earned at least one postsecondary credential within three years of enrollment (THEC, 2019).

Given that Promise covers up to the full cost of tuition and mandatory fees, it is possible that students may still borrow from public or private sources to cover the full cost of attendance, though this may be minimal in practice. Tennessee operates robust merit- and need-based financial aid programs, where students are eligible to receive excess funds above tuition and mandatory fee charges to cover other costs of attendance. Additionally, reductions in the need to borrow and extent of any subsequent borrowing should still be expected given the introduction of Promise. If students' need to borrow includes a cost of attendance that is reduced by the elimination of tuition and mandatory fees, any remaining borrowing should still decline given a smaller gap between these costs and financial aid.

Data

Data for our study come from three sources: tnAchieves records on student enrollment in local programs, THEC reports on Promise enrollment by community college, and the Integrated Postsecondary Education Data System (IPEDS). We constructed a panel dataset of institutions spanning academic years 2007-08 through 2017-18 to capture 8 years prior to the state's Promise

adoption (including outcomes 2 years prior to any local program) and 3 years following the introduction of the statewide Promise. Beginning with the population of institutions, we limited our sample to public, two-year institutions in the United States who are degree-granting and do not solely provide instruction via distance education. We also only included institutions that have FTFT undergraduate students and whose highest award is an associate ($n=866$).⁹ For any missing data (outcomes and covariates), we used linear interpolation, but 6 institutions did not report any tuition and fee information to allow for interpolation of that covariate, so they were dropped. Further, we dropped 15 institutions that did not report to IPEDS across the 2007-08 through 2017-18 panel. These included new institutions that appeared in 2009-10 or later.

We further limited the sample to those community colleges that awarded loans for the duration of the observation period by excluding those who reported \$0 in loans from any source across the entire panel ($n=48$) and those who had a sustained discontinuation of borrowing prior to fall 2015 ($n=34$).¹⁰ Institutions lose access to federal financial aid if respective cohort default rates (CDR) exceed 40% for 1 year or 30% for 3 consecutive years (Wiederspan, 2016). To avoid enrollment declines that accompany loss of access to federal aid, colleges near a CDR threshold may opt out of the federal loan program (Darolia, 2013). Limiting the sample to institutions that awarded loans for the entirety of the observation period ensures institutions that stopped offering federal loans do not confound our estimates. Our final analytic sample consists of 763 institutions across 11 academic years.¹¹

⁹ Community colleges in Tennessee award associate degrees as the highest credential, so these institutions may be more comparable, and student borrowing may be systematically different at baccalaureate-granting colleges.

¹⁰ We operationalize a sustained discontinuation of borrowing as the sum total of loans from all sources dropping to \$0 and remaining at \$0 into the 2015-16 academic year.

¹¹ Tennessee has 13 community colleges, but our sample only covers 11: One did not report loan information to IPEDS and the other had a sustained discontinuation in borrowing prior to fall 2015.

The outcomes of interest are the percent of FTFT undergraduate students who borrowed from any loan program and the average loan from all sources for that year's financial aid cohort.¹² We are particularly interested in outcomes for FTFT undergraduate students given Promise's exclusive eligibility to students who meet both of these conditions. Guided by prior studies and Chen's (2008) framework, we collected a host of time-variant controls across demographic and financial factors associated with loans and borrowing behavior.¹³ These include in-state tuition and mandatory fee costs and average financial aid awards from federal and institutional sources to control mechanical changes in costs and other available resources as we work to identify the impact of Promise on these borrowing outcomes. We also capture enrollment figures representing the proportions of FTFT students who are Pell recipients, Black, Hispanic, and adults (age 25 and older) to control student demographic figures associated with borrowing behaviors and loan preferences (Boatman et al., 2017; Hillman, 2015). We adjust all financial figures for inflation to the most recent year in the panel (2018).¹⁴

Empirical Strategy

Given Promise's 2015-16 statewide introduction, we first employ a traditional quasi-experimental difference-in-differences (DID) method. Second, given the presence of local programs prior to the statewide Promise, we exploit campus-level variation in the percent of the FTFT cohort eligible for a promise program with a dosage measure. In the Appendix, we implement an event-study design and additionally alter the counterfactual groups presented

¹² Average loan amount by community college was computed from the sum total loan volume in an academic year awarded to FTFT undergraduates over the FTFT undergraduate financial aid cohort.

¹³ Our findings are robust to the inclusion or exclusion of these individual covariates, and Cellini (2008) shows that difference-in-differences methods provide strong control over omitted variable bias in financial-aid studies. General practice also discourages the interpretation of control variables—which are meant to improve precision—in quasi-experimental studies (Hünemund & Louw, 2020).

¹⁴ Average grant award amounts were computed from the total grant volume from each respective source awarded to FTFT undergraduates over the FTFT undergraduate financial aid cohort.

below for robustness. We also test the sensitivity of our estimates to the inclusion of an institution-specific linear time trend and consider the introduction of lagged dependent variables.

Difference-in-Differences: Binary Treatment

Consistent with prior promise evaluations, we employ a DID strategy to exploit across-college and inter-temporal variation to compare borrowing behavior at community colleges in Tennessee to those outside the state (i.e., controls), before and after the fall 2015 introduction of Promise. Formally, we first specify

$$y_{it} = \alpha_0 + \beta(\text{Treat}_i \times \text{Post}_{it})_{it} + \mathbf{X}'_{it}\delta + \pi_i + \rho_t + \varepsilon_{it}, \quad (1)$$

where y_{it} is the outcome of interest for college i in year t , conditioned on college (π_i) and year (ρ_t) fixed effects. The product of $(\text{Treat} \times \text{Post})_{it}$ is a binary indicator identifying community colleges in Tennessee (Treat_i) and post-Promise years (Post_{it}), which takes a value of 1 for community colleges in Tennessee in 2015-16 and later and 0 otherwise. \mathbf{X}_{it} represents a vector of the time-variant, college-characteristic controls noted above. β is the causal effect of Promise on y_{it} . We estimate robust standard errors conservatively clustered at the state level to account for serial correlation in outcomes and weight each model by the size of the FTFT financial aid cohort (Abadie et al., 2017; Bertrand et al., 2004).¹⁵

Because selection of an optimal comparison group is empirically unguided, we first present estimates for three separate groups: all other community colleges in the nation ($n=762$), community colleges in Southern Regional Education Board states (SREB; $n=261$), and community colleges in states contiguous to Tennessee ($n=156$). These samples range from the entire population of other community colleges to those in neighbor states who were not exposed to Promise but are similar on many factors. While larger samples (i.e., nation) provide superior

¹⁵ Our findings are qualitatively equivalent when clustering at the institution level.

statistical power, they reflect the bias-variance tradeoff—potentially introducing dissimilar peers into our comparisons. The isolation of regional and contiguous peers mirrors that of Dynarski (2000) and Nguyen (2020).

Descriptive statistics are presented in Table A2. The percent of FTFT students in Tennessee who borrow and the average amount of those loans are lower than the national average yet similar to contiguous peers. Tennessee is similar to national peers on demographic and financial characteristics: Both have similar federal and institutional aid awards, as well as comparable enrollments of Pell, Black, and adult students. Tennessee enrolls a smaller proportion of Hispanic students, but this figure is very similar to its contiguous peers. These similarities across comparison groups suggest each may serve as a suitable counterfactual and control secular trends in loan outcomes (Kahn-Lang & Lang, 2020). We also note that Tennessee shares similarities to these peers on other related features, including its bachelor's degree attainment rate (24.4% in 2014 compared to 27.1% in the South and 29.3% in the nation; U.S. Census Bureau, 2014), unemployment rate (6.7% in Tennessee, 6.0% in the South, and 6.2% in the U.S. in 2014; Bureau of Labor Statistics, 2015), and political representation (72% state house Republican majority in 2014 for Tennessee and for 61% for Southern states on average; Council on State Governments, 2014). Further, in addition to similarities in students' enrollment by race in Tennessee, community colleges in the state also remain similar on completion rates and student loan default. The national six-year graduation rates for community colleges was 30.3% for the 2013 entering cohort compared to Tennessee community colleges' 33.2% (THEC, 2020a; U.S. Department of Education, 2019), and the three-year (2016) cohort default rate for community colleges in Tennessee was 16.9% compared to the national two-year institution average of 15.9% (THEC, 2020a; U.S. Department of Education, 2020). Finally, given the

assumption that treatment and control groups are exposed and respond similarly to external factors, we are unaware of contemporaneous shocks—particularly to the SREB and contiguous peers—that could differentially impact our outcomes of interest.

Trends in the outcome variables for Tennessee are presented in Table A3. Borrowing behaviors sharply decreased after full implementation of Promise, with both the percent of students borrowing and the average loan amount declining by nearly 50% from 2014-15 to 2015-16. The percent of students borrowing declined from 17.1% in 2014-15 to 9.0% in 2015-16, and the average cohort loan declined from \$776 in 2014-15 to \$403 in 2015-16. Mean differences for our outcomes of interest comparing Tennessee to the three counterfactual groups are presented in Table A4. With a DID design, our assumption is that these post-Promise reductions are due to an effect of Promise and not to a contemporaneous treatment. While Tennessee has long been an innovator in education policy, we are unaware of other treatments across the study horizon that could affect borrowing. Most notably, the state made changes to remedial and developmental education in 2012 and restructured its higher education governance structure in 2016—though neither should affect borrowing—and the state’s adult free-college program (Tennessee Reconnect) was not implemented until the 2018-19 academic year, after the study’s horizon (Kane et al., 2018; THEC, 2016, 2020b). Further, while Promise features a mentorship component available to all Promise-eligible students, financial aid guidance is not included.¹⁶

The primary condition of a DID strategy is that treatment and control groups exhibit parallel outcome trends prior to a policy change, with a related assumption that these parallel trends would continue in the absence of an intervention. While we cannot formally test this

¹⁶ Mentors remind students of Promise and FAFSA deadlines, connect students with existing resources, and provide support and encouragement. Mentors do not provide financial aid advice to students and are not aware of any student financial information. Mentors are directed to instruct students to contact their institution for aid matters.

assumption in the potential-outcomes framework, we present aggregated outcome trends in Figure 1. Trends adhere to the parallel-trends assumption in pre-Promise years, and a sharp decline is observed in the percent borrowing and average loan following the 2015-16 introduction of Promise.¹⁷ This plausibility of the parallel-trends assumption further supports our selection of counterfactual groups. A slight deviation is observed for Tennessee in the percent borrowing beginning in 2013-14, likely attributable to 7 community colleges having first-time freshman exposed to local promise programs and 11.5% of that entering class eligible for a local scholarship. This trend change motivates our second specification, controlling for variation in Promise eligibility prior to 2015-16.

Difference-in-Differences: Continuous Treatment (Dosage)

An important factor concerning any evaluation of Promise is its pseudo-staggered implementation. As mentioned, several counties in Tennessee implemented local programs prior to the fall 2015 statewide implementation. Therefore, estimates of Promise's effect on borrowing that consider a sharp implementation timeline as in Equation 1 may be downwardly biased given the presence of treated students in years prior to 2015-16. Thus, we augment the traditional (binary) DID estimate by specifying a staggered model with a dosage indicator as

$$y_{it} = \alpha_0 + \beta \text{Promise}_{it} + \mathbf{X}'_{it} \delta + \pi_i + \rho_t + \varepsilon_{it}, \quad (2)$$

where Promise_{it} is a continuous treatment variable, defined as the proportion of each community college i 's first-year students eligible for a promise scholarship in a given academic

¹⁷ A deviation from this trend is observed for the percent borrowing in 2010-11. This deviation is driven entirely by one community college whose proportion of FTFT freshman borrowing rose from 17% in 2009-10 to 79% in 2010-11 and then fell to 34% in 2011-12. These figures were confirmed with U.S. Department of Education Title IV Program Volume reports, and the campus reported a substantial change in loan-packaging practices in 2010-11 that was later reversed. This deviation is well before the fall 2015 implementation of Promise, and Tennessee's trend excluding this institution is also presented in Figure 1, which appears parallel to all counterfactual groups.

year t .¹⁸ Enrollment data were provided by tnAchieves and THEC, and enrollment proportions were computed using the FTFT financial aid cohort retrieved from IPEDS. This dosage strategy mirrors that of Carruthers and Fox (2016) to exploit variation between community colleges in the proportion of entering classes who were eligible for a promise program, as well as the DID dosage and continuous treatment models employed by Kelchen et al. (2019). In this framework, β represents the conditional change in y_{it} for every 1 percentage point change in the proportion of the entering class eligible for a promise scholarship. Given variation in eligibility dosage among community colleges in Tennessee, combining these estimation strategies allows for a more accurate and unbiased estimate of the effect of Promise.

Results

Traditional DID estimates of the effect of Promise on each outcome are presented in Table 1 by counterfactual group. Comparing borrowing at community colleges in Tennessee to those across the nation, estimates suggest Promise reduced the percent of FTFT students who borrow by 8.85 percentage points (39.7%) and reduced the average first-year loan by \$260.80 (26.4%). Considering Tennessee's regionally proximate and qualitatively similar peers, however, these effect estimates are slightly larger. For the percent borrowing outcome, the estimated effect of Promise ranges from a 10.05 percentage point (45.0%) decline in the SREB comparison to a 10.29 percentage point (46.1%) decline in the contiguous comparison. Similarly, for the average loan outcome, estimates range from a reduction of \$359.78 (36.4%) to \$364.20 (36.8%) considering the SREB and contiguous counterfactuals, respectively.

¹⁸ Counts of "eligible" students capture those who have completed all necessary requirements to receive a local promise scholarship or the statewide Promise scholarship. Eligible students may or may not receive actual funding given the programs' last-dollar designs. We are unable to detect actual scholarship receipt with our data.

Results for the continuous treatment (dosage) models are presented in Table 2. In addition to coefficients, this table also displays the estimated influence of Promise given the community colleges' increased proportion of students eligible for a promise program. The "Promise Enrollment" coefficient estimates the change in borrowing for every 1 percentage point change in the eligible population.¹⁹ Across both outcomes and three comparison groups, similar patterns emerge to those in the traditional specification and provide qualitatively equivalent findings.²⁰ Across each counterfactual group, the percent borrowing models suggests Promise was associated with an approximately 0.13 to 0.14 percentage point decline in the proportion of students borrowing, on average, for every 1 percentage point increase in the proportion of the entering cohort treated by Promise. This translates to an average decline of 8.42 percentage points (37.7%) after full implementation in the national model, 9.73 percentage points (43.6%) in the SREB model, and 9.79 percentage points (43.9%) in the contiguous model. Table 2 also presents these estimates for the average loan outcome, and estimates suggest Promise is associated with an average decline in the cohort loan of \$234.16 (23.7%) in the national comparison and between \$339.29 (34.3%) and \$331.26 (33.5%) in the regional SREB and contiguous comparisons, respectively.

While this model specification accounts for treatment intensity of Promise-eligible students at colleges, these results are statistically indistinguishable from those derived in the

¹⁹ After full implementation of Promise, community colleges in Tennessee moved from a mean eligibility proportion of 5.23% (across 2007-08 through 2014-15 for those participating in local promise programs) to 73.77% (across 2015-16 through 2017-18); a change of 68.54 percentage points. Multiplying β by this constant estimates the expected change in borrowing after implementation of the statewide Promise given an aggregated change in dosage.

²⁰ We also find qualitatively equivalent estimates when we implement 1) a specification where we center colleges at their first adoption year and weight by the promise-eligible enrollment proportion and 2) a generalized DID specification accounting for time-varying regional promise and statewide Promise adoptions.

traditional DID specification.²¹ The maximum nominal difference between the binary and dosage models is 0.50 percentage points for percent borrowing and \$33 for the average loan. These results suggest that, while there was early treatment by local programs, the fact that only a maximum of 13.88% of FTFT students were *eligible* for a local program in 2014-15 may have not been enough to meaningfully bias the estimates from Equation 1—particularly since it is likely that an even smaller percent were actually treated with a local scholarship.²² In all, these results suggest large and consistently-estimated declines in borrowing behavior at Tennessee’s community colleges following the introduction of Promise. Across all models, estimates suggest the percent borrowing declined by 8.42-10.29 percentage points (37.7-46.1%) and that the average first-year loan for FTFT students declined by \$234.16-\$364.20 (23.7-36.8%). As noted, the Appendix details the results of multiple robustness checks and sensitivity analyses (omitted here for brevity), which provide further confidence in our findings and strong evidence for these large and meaningful impacts.

Discussion

Since the Kalamazoo Promise launch in 2005, some 300 or more promise programs have been advanced at federal, state, and local levels with noted intentions to increase college access through improved affordability. Yet, despite this programmatic growth, research has failed to keep pace, with an important piece of the access and affordability equation left unconsidered: student borrowing. Using federal, state, and program-level data, we leveraged a natural experiment to estimate causal impacts of Tennessee Promise on students’ borrowing behaviors in

²¹ Z tests for differences between the binary DID indicator and the dosage enrollment variable across both outcomes and all counterfactual groups all fail to reject the null. In the national counterfactual, for example, the p value on this test ($H_0: \beta^{\text{Model 1}} = \beta^{\text{Model 2}}$) is 0.29 for the percent borrowing outcome and 0.33 for the average loan outcome.

²² Recall, the Promise_{it} indicator in Equation 2 captures the proportion of each community college’s first-year students *eligible* for a promise scholarship; not a measure of the proportion who actually received last-dollar money. Nevertheless, the fact that models incorporating fixed-point policy adoptions and enrollment intensities produce equivalent estimates suggests our findings are robust and relatively insensitive.

the state's community college system. In all, we found robust evidence to suggest the program reduced the percent of FTFT students borrowing by 8-10 percentage points (over 40%) after implementation and reduced the average community college cohort loan by \$230-360 (nearly 32%). In this light, Promise not only increased enrollments and degree attainment, but effectively reduced students' reliance on loans (Carruthers et al., 2018; Nguyen, 2020). As the first study to link a promise program with changes in borrowing, our work contributes to the growing body of evidence on these place-based scholarships and provides salient implications for policy: Promise programs are one possible avenue to higher education not conditioned upon the accumulation of student debt. Importantly, we also provide a useful extension to emerging evidence on the crowding out effect of grant aid on loans by considering the impact of grant aid from a universal promise program rather than a need- or merit-based source.

Our findings suggest the introduction of new grant aid via Promise was an effective replacement for student loans. That is, Promise was a source of aid students could have used wholly in place of loans or to reduce financial gaps that could have been covered by (larger) loans, leading to significant reductions in the percent of students borrowing and in the average amount of any loans that were originated thereafter. To fully consider this possibility, it is helpful to consider our findings alongside prior works in this area. Across the first three cohorts, the average annual Tennessee Promise award was \$1,154 overall and \$2,021 among recipients.²³ Therefore, our \$230-360 loan reduction estimates would suggest every \$1.00 of Promise was associated with a reduction in total first-year loans among Promise and non-Promise students of \$0.20-0.31. Given these are lower-bound approximations because not all community college students are eligible for Promise, these figures align with those of Marx and Turner (2018) and

²³ Given the program's last-dollar design, the overall figure captures \$0 awards for students who were eligible for an award but whose tuition and mandatory fees were fully covered by other grant aid.

Evans and Nguyen (2019) who found \$1.00 increases in Pell crowded out loans by \$0.43 and \$0.27-0.36 (respectively) over all students.²⁴ Further, Marx and Turner (2018) and Denning et al. (2019) estimated grant aid to crowd out loans at rates in excess of 100% for borrowers.

Recognizing that the average pre-Promise loan at Tennessee community colleges was \$988.58 and that the statewide Promise treated 68.54 percentage points more FTFT students after full implementation, a 100% replacement of loans (i.e., \$0 borrowed by Promise-eligible students) would suggest an average loan reduction of \$311.01, a figure consistent with our findings across specifications and comparison groups [$\$988.58 - (\$988.58 \times 0.6854)$]. These estimates suggest our findings are consistent with prior works, including those by DesJardins and McCall (2014) and both Chapman's (2016) and Scott-Clayton's (2011) evaluation of non-need-based programs, suggesting Promise served as a replacement for loans—particularly given its last-dollar design for students who would have borrowed.

While our findings suggest that a universal, last-dollar promise program provided a near-equivalent reduction in loan debt than some merit- and need-based counterparts (based on prior works), we must discuss the generalizability of our findings given data limitations and Tennessee's policy context. First, while we leverage institution-level data from federal, state, and private sources, our analyses are limited by our inability to estimate treatment effects across student subgroups and to garner more-precise estimates of changes in borrowing at the student-level. Though we employ altered specifications to exploit variation in eligibility for a promise program, we are nevertheless unable to detect the true dosage of Promise by student. This also means we are unable to fully consider heterogeneous treatment effects across students' race and socioeconomic status—dimensions prior works have found to matter for borrowing behaviors

²⁴ For comparison, Evans and Nguyen (2019) found \$1,100 in grants reduced loans by \$300-400 on average—a treatment level functionally equivalent to the \$1,154 average Promise award.

(Chen, 2008; Kim, 2007). Yet, given Tennessee's average annual tuition and mandatory fee rate of \$4,335 at community colleges in 2017-18, students eligible for Pell (maximum of \$5,920) or the state's merit or need-based community college awards noted earlier (\$3,000 and \$1,300, respectively) are unlikely to receive much financial support from Promise, though they are still able to receive an award for any gap between their tuition and mandatory fee charges and existing financial aid (THEC, 2018). This suggests those set to gain the most from Promise are students from middle- or high-income families, regardless of their academic achievement. This reality is a common criticism of last-dollar programs (Poutre & Voight, 2018) and one observed to occur by Gurantz (2020) in his evaluation of the Oregon Promise. This is not to suggest that Promise could not reduce the borrowing behaviors of low-income students, but the reality is that these students, on average, likely had a small gap between their tuition and mandatory fee charges and existing grant aid (if one at all) for Tennessee Promise to fill. Furthermore, while Promise has become a model for replication in other states (Carruthers, 2019; Wermund, 2019), it may not be a representative place-based scholarship program given its universal eligibility and last-dollar design, suggesting these findings may not hold across the diversity of programmatic goals, eligibility criterion, award mechanisms, and requirements for participation that exist. Future studies will likely observe heterogeneous effects as programmatic design diverges from that in Tennessee.

Though our analysis incorporates multiple robustness checks and sensitivity analyses, important limitations still exist. While our analyses consistently suggest that Promise reduced the prevalence and intensity of borrowing, an important question remains: For whom did Promise reduce borrowing? Place-based programs have been shown to affect students at the intensive enrollment margin—namely, whether to attend a two- or four-year institution. Indeed, Carruthers

and Fox (2016) found Knox Achieves diverted high-achieving students toward community colleges. In this reality, it is possible Promise induced students who were already loan averse or less likely to borrow to enroll in a community college, by way of private-to-public or university-to-community college diversion. We could therefore misattribute these changes in loan behaviors as an effect of aid via Promise rather than simply a change in enrollment composition—or of enrollment intensity considering a shift from part-time to full-time enrollment. It is undoubtable that Promise changed the composition of colleges in Tennessee given the state’s nominal increase in first-time freshman enrollment in community colleges of 27.7% in the first year alone. Yet, we argue this limitation does not negate our findings in practice, and our findings of *reduced* borrowing given increased enrollment intensity makes them particularly noteworthy. Nguyen (2020) uses a quasi-experimental design to detail enrollment changes in Tennessee following Promise, finding a 40% increase in FTFT enrollment at community colleges attributable to Promise yet only a 2% decrease in university enrollment (estimated to be only 100 students per college), which disappears in the second year of the program’s operation. These findings are similar to Gurantz’s (2020) findings on the Oregon Promise, noting “increased community college enrollment in the first year of the program came predominately as students shifted out of four-year colleges, whereas by the second year the program induced gains in overall postsecondary attendance” (p. 12). These observed overall enrollment increases and the fading out of university diversion are key and support our ultimate conclusion: Even with enrollment shifts, Promise brought new students into the two-year higher education sector, reduced the proportion who borrowed, and, among those who did borrow, reduced their average first-year loan amount. Even with a fading of university diversion, our raw and event study plots (Figures 1 and A1) do not suggest a decay in this effect of Promise as new cohorts entered higher

education. This is particularly important given that Nguyen (2020) observed the largest new enrollment gains in Tennessee to be among Black students, a group particularly harmed by loan debt (Gross et al., 2010; Miller, 2019).

As the first study to causally link a promise program to student loan behaviors, our work extends this growing body of evidence to fill existing gaps in knowledge surrounding promise students' financial outcomes yet additionally contributes in other ways. We extend the growing body of evidence considering the interaction of grant aid with other sources of aid to consider grants provided not by need- or merit-based sources but instead by a functionally universal scholarship program. These findings have salient implications for public policy as the costs and benefits of promise programs are debated at the federal, state, and local levels. Loans alleviate credit constraints for students seeking higher education, yet their burden is held unevenly across racial groups and institutional types. Against the backdrop of support for promise programs as avenues of increased access and degree attainment, our work suggests promise programs may also be a viable mechanism to reduce the prevalence and intensity of borrowing at community colleges, institutions that serve a disproportionate share of the nation's low-income and racial minority students (Bailey et al., 2005). Our findings also beg further work in this area. Research is needed to better understand student behavior as a response to grant aid and loan programs in the promise-program era. Future studies should consider what effect the receipt of grant over loan aid (or the complete elimination of loan debt) has on other outcomes, including retention, completion, workforce integration, and long-run economic prosperity.

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Tables

Table 1. *Difference-in-differences (binary) estimate for effect of Tennessee Promise.*

	Percent Borrowing			Average Loan		
	Nation	SREB	Contiguous	Nation	SREB	Contiguous
Promise (DID)	-8.85*** (0.80)	-10.05*** (1.01)	-10.29*** (1.11)	-260.80*** (58.63)	-359.78*** (66.29)	-364.20** (77.40)
Percent Black	0.30* (0.12)	0.34* (0.14)	0.29 (0.20)	21.19* (8.17)	21.54* (8.63)	21.00+ (9.39)
Percent Hispanic	-0.13+ (0.07)	0.10 (0.15)	0.50 (0.28)	-6.88+ (3.80)	-2.06 (8.18)	22.07 (12.44)
Percent Over 25	0.31*** (0.05)	0.38* (0.14)	0.44** (0.10)	22.10*** (4.09)	23.28** (6.89)	20.45** (5.91)
Tuition and Fees	0.17+ (0.09)	0.12 (0.13)	0.11 (0.11)	12.62* (4.98)	7.41 (6.94)	10.03 (6.34)
Federal Grants	0.55*** (0.08)	0.46*** (0.07)	0.45** (0.11)	37.70*** (4.79)	34.21*** (5.03)	26.73*** (4.96)
Institutional Grants	-0.12 (0.11)	-0.18 (0.15)	-0.27 (0.24)	-5.99 (5.70)	-8.04 (7.72)	-12.54 (7.76)
Adj. R^2	0.868	0.758	0.756	0.857	0.733	0.731
Observations	8,393	2,992	1,837	8,393	2,992	1,837
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Institution Fixed Effects	Y	Y	Y	Y	Y	Y

+ $p \leq .10$ * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table reports coefficients and robust standard errors (in parentheses, clustered by state); Figures rounded; Each specification is weighted by institutions' FTFT DS UG financial aid cohort; Nation includes all other institutions in the United States; SREB includes institutions in the Southern Regional Education Board member area; Contiguous includes institutions in states geographically adjacent to Tennessee; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates; Tuition and fees, federal grants, and institutional grants scaled by \$100.

Table 2. *Estimated influence (dosage treatment) of Tennessee Promise enrollment.*

	Percent Borrowing			Average Loan		
	Nation	SREB	Contiguous	Nation	SREB	Contiguous
Promise Enrollment	-8.42*** -0.13 (0.01)	-9.73*** -0.14 (0.01)	-9.79*** -0.14 (0.02)	-234.16*** -3.42 (0.83)	-339.28*** -4.95 (0.96)	-331.26** -4.83 (1.13)
Percent Black	0.30* (0.12)	0.34* (0.15)	0.30 (0.20)	21.21* (8.17)	21.60* (8.63)	21.07+ (9.41)
Percent Hispanic	-0.13+ (0.07)	0.10 (0.15)	0.49 (0.28)	-6.87+ (3.80)	-2.11 (8.23)	22.29 (12.41)
Percent Over 25	0.30*** (0.05)	0.37* (0.14)	0.43** (0.10)	22.12*** (4.10)	23.16** (6.89)	20.34** (5.91)
Tuition and Fees	0.17+ (0.09)	0.12 (0.13)	0.11 (0.11)	12.63* (4.98)	7.44 (6.94)	10.06 (6.40)
Federal Grants	0.55*** (0.08)	0.46*** (0.07)	0.44** (0.11)	37.72*** (4.79)	34.22*** (5.03)	26.76*** (4.97)
Institutional Grants	-0.12 (0.11)	-0.17 (0.15)	-0.26 (0.23)	-5.87 (5.68)	-7.87 (7.65)	-11.98 (7.48)
Adj. R^2	0.868	0.759	0.756	0.857	0.733	0.730
Observations	8,393	2,992	1,837	8,393	2,992	1,837
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Institution Fixed Effects	Y	Y	Y	Y	Y	Y

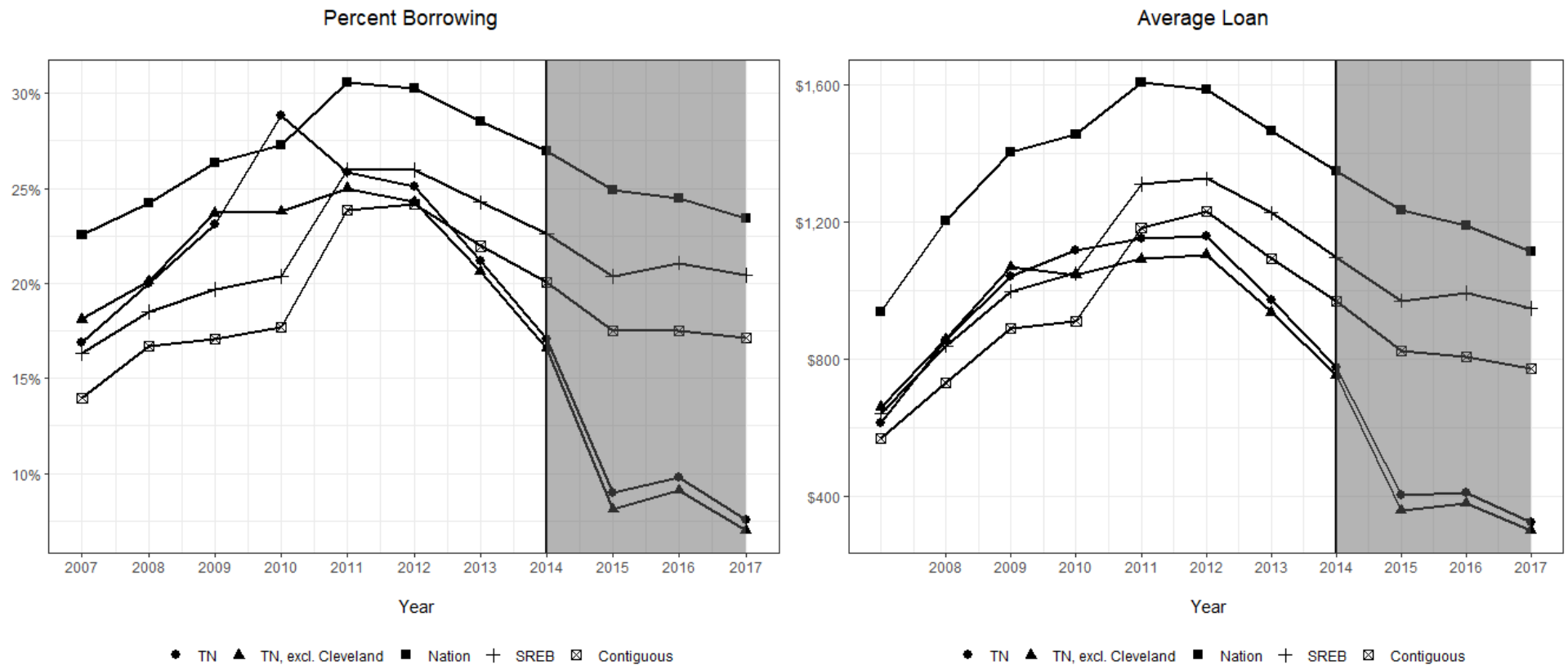
+ $p \leq .10$ * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table reports coefficients and robust standard errors (in parentheses, clustered by state); Figures rounded; Each specification is weighted by institutions' FTFT DS UG financial aid cohort; Nation includes all other institutions in the United States; SREB includes institutions in the Southern Regional Education Board member area; Contiguous includes institutions in states geographically adjacent to Tennessee; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Promise Enrollment is the proportion of the financial aid cohort who are eligible to receive Promise scholarship money; For the first row (Promise Enrollment): The leading figure estimates the effect of increasing the mean proportion eligible by 68.54 percentage points ($\beta * 68.54$, the mean change in enrollment from pre- to post-Promise) on the outcome, and the second is the estimated coefficient for a 1-percentage point change in Promise-eligible enrollment on the outcome; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates; Tuition and fees, federal grants, and institutional grants scaled by \$100.

Figures

Figure 1. *Parallel trend plots.*



Source: IPEDS; 2007-08 through 2017-18.

Notes: Plots show mean outcomes by year for community colleges in Tennessee over time and those for three primary counterfactual groups (identified by point shape); 2014 identifies academic year 2014-15, the year immediately prior to Tennessee Promise, and shading identifies the post-treatment period; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan is in dollars (\$), computed from total amount over FTFT DS UG financial aid cohort, and adjusted for inflation (2018 CPI); Loans include any source.

Appendix

Robustness

In addition to altering our counterfactual groups, we conduct an event study to test for pre-treatment effects in years prior to 2015-16 and to estimate the magnitude of differences following Promise adoption. Here, we seek to ensure the results are not driven by outcome deviations in pre-treatment years, a condition of the DID estimator. This primary robustness check allows us to assess plausibility of the parallel-trends assumption—similar to multiple placebo or falsification tests—and to detect whether the effect size grows or decays over time, relative to the year prior to adoption (St. Clair & Cook, 2015). Specifically, we estimate

$$y_{it} = \alpha_0 + \beta \sum_{t=2007}^{2017, \neq 2014} (TN_i \times \rho_t)_{it} + \mathbf{X}'_{it} \delta + \pi_i + \rho_t + \varepsilon_{it} , \quad (A1)$$

where we interact a dummy treatment indicator equal to 1 for institutions in Tennessee (TN_i) with each year factor (ρ_t), omitting the year immediately prior to Promise (2014-15) as reference. Event study plots with treatment estimates for each year and 95% confidence intervals are presented in Figure A1. We expect significant treatment effects to be absent across the 2007-08 through 2013-14 horizon—or for effects to be in the opposite direction as hypothesized—but for significant and negative effects to be estimated following program adoption. Results from the event study design with the national counterfactual support prior findings of statistically significant decreases in borrowing following the introduction of Promise. We observe significant differences between Tennessee and national comparisons for the percent borrowing outcome prior to Promise, but these differences are in the opposite direction—where community colleges in Tennessee had significantly *higher* borrowing than peers. The significant *reductions* observed in 2015-16, 2016-17, and 2017-18 provide further evidence that our DID estimates are valid and not driven by prior outcome trends. Further, these event study plots suggest the reductions in the

percent borrowing and average loan outcomes are relatively stable across the three years of treatment we can observe.

In addition to this primary robustness check, we further alter our counterfactual group to exclude institutions in the five other states that operate a statewide promise program as defined by Perna and Leigh (2018). These states include Delaware, Kentucky, Minnesota, Oregon, and Rhode Island. The presence of these institutions may downwardly bias our estimates—particularly in the national comparison—if these programs (currently treated as controls) did affect borrowing behaviors. Results from this altered specification are presented in Table A5. Again, estimates across the binary and dosage models are highly significant and suggest a substantial reduction in borrowing following Tennessee Promise. Estimates for the percent borrowing outcome range from 9.03-9.49-point reductions (approximately 41.5%), and estimates for the average loan outcome range from a reduction of \$289.66 to \$318.48 (approximately 30.8%). These estimates are qualitatively similar to those in the SREB and contiguous groups (in Tables 1 and 2) given their similar exclusion of four of these five states.

Sensitivity

In addition to saturating the model in Equation 1 with institution and year fixed effects, we incorporate an institution-specific linear time trend into the DID estimator. Fixed effects specifications are thought to be more flexible than unit-specific time trends, which could control for additional variation if borrowing patterns followed separate time trends across institutions (Delaney & Kearney, 2015). An institution-specific linear time trend can be used to account for possible systematic time-series outcome variation by institution in pre-Promise years (Friedberg, 1998; Wolfers, 2006). Here, we re-specify Equation 1 as

$$y_{it} = \alpha_0 + \beta(\text{Treat}_i \times \text{Post}_{it})_{it} + (\pi_i \times \tau_{it})_{it} + \mathbf{X}'_{it}\delta + \pi_i + \rho_t + \varepsilon_{it}, \quad (\text{A2})$$

where we interact a continuous trend variable $\tau = 1, 2, 3, \dots, 11$ across each institution as prescribed by Wolfers (2006), allowing trend slopes to vary (Jacobson et al., 1993). Results for this estimator are presented in Table A6. Across counterfactual comparison groups, estimates suggest Promise reduced the proportion of students borrowing by 5.17-6.47 percentage points (23.2-29.0%) across the national, SREB, and contiguous comparisons. Estimates of Promise's effect on the average cohort loan, however, are less precisely estimated, though still suggest a reduction in the average cohort loan occurred, ranging from \$118.65 (12.0%, $p < .10$) in the national model to \$233.46 (23.6%) in the contiguous comparison. The SREB comparison did not reach statistical significance but is qualitatively equivalent to the national point estimate. While these estimates are smaller and less significant than those from prior models, it is possible a rigorous specification with three fixed effects over controls for institutional trends, over-imposes its pre-specified functional form, and absorbs variation in post-policy differences that should instead be captured by β (Jacobson et al., 1993; Wolfers, 2006). Yet, our inferences remain unchanged, suggesting these estimates likely represent a lower-bound on the effect of Promise on borrowing behaviors.

To further test the sensitivity of our model specifications, we incorporate lagged dependent variables into our primary models in place of unit fixed effects. As Angrist and Pischke (2009) show, lagged dependent variables and fixed effects hold a “bracketing property” (p. 245) where fixed effects estimators may provide positive treatment estimates that are too large while models with lagged dependent variables may tend to provide estimates that are too small. This bounds the causal estimate. In Table A7, we show estimates from models with a lagged dependent variable to further test a lower-bound of the effect of Promise. As expected, estimates are nominally smaller yet remain statistically significant and substantively meaningful:

a 4.47-4.84 point (20.0-21.7%) reduction in the percent borrowing and a \$213-229 (21.6-23.1%) reduction in the average loan amount ($p < .001$).²⁵ In all, these robustness checks and sensitivity analyses provide strong confidence in our results, which consistently suggest Promise had a large and meaningful impact on students' borrowing behaviors.

²⁵ We find qualitatively equivalent estimates when we also implement a specification that incorporates both unit and year fixed effects plus a lagged dependent variable, though Angrist and Pischke (2009) caution this given the necessary conditions for consistent estimation under one such model.

Table A1. *Percent of entering financial aid cohort eligible for Tennessee Promise.*

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Chattanooga	-	-	-	-	-	-	-	-	59.51	64.55	67.47
Cleveland	-	-	-	-	-	24.31	27.14	27.97	57.55	67.24	75.33
Columbia	-	-	-	-	-	-	-	-	80.58	85.56	80.60
Dyersburg	-	-	-	-	-	1.05	9.31	18.21	56.82	68.02	62.62
Jackson	-	-	-	-	-	0.13	0.53	0.64	66.41	73.35	73.06
Motlow	-	-	-	-	-	-	-	-	75.17	81.11	81.20
Nashville	-	-	-	-	-	-	-	20.04	64.02	70.36	64.75
Northeast	-	-	-	-	-	3.58	0.89	1.60	75.72	81.82	78.39
Pellissippi	-	-	12.44	15.27	23.26	34.55	33.89	29.20	75.56	78.55	77.19
Roane	-	-	3.03	6.24	5.34	51.31	53.95	50.35	90.23	94.54	92.28
Volunteer	-	-	-	-	-	0.95	0.26	4.64	68.00	72.13	74.63
Total	-	-	1.41	1.96	2.60	10.53	11.45	13.88	69.96	76.11	75.23

Source: tnAchieves, Tennessee Higher Education Commission, and IPEDS; 2007-08 through 2017-18.

Notes: Table presents percent of FTFT DS UG enrollment eligible for Tennessee Promise computed from total number of Promise-eligible, first-year students enrolled (tnAchieves, THEC) over the FTFT DS UG financial aid cohort (IPEDS); Figures rounded; A cell containing “-” indicates zero percent of FTFT DS UG students were Promise-eligible; The first year of statewide Tennessee Promise was 2015-16.

Table A2. *Descriptive statistics.*

	TN	Nation	SREB	Contiguous	Total
Loans					
Percent Borrowing	17.54 (10.59)	24.33 (19.55)	24.75 (16.90)	22.48 (14.85)	24.20 (19.44)
Average Loan	819.73 (546.15)	1,180.13 (1,070.16)	1,204.57 (946.60)	1,061.48 (765.98)	1,173.33 (1,063.8)
Demographics					
Percent Black	10.32 (7.75)	13.97 (12.91)	21.19 (15.18)	22.16 (15.92)	13.90 (12.84)
Percent Hispanic	3.27 (0.94)	19.22 (18.83)	15.22 (18.76)	5.53 (4.77)	18.92 (18.78)
Percent Over 25	30.21 (6.54)	33.65 (9.40)	33.92 (10.00)	35.06 (9.46)	33.59 (9.37)
Finance					
Percent Pell	59.29 (8.82)	54.75 (13.48)	57.43 (13.83)	60.77 (11.55)	54.84 (13.42)
Tuition and Fees	4,034.47 (35.02)	3,354.97 (1,392.73)	3,148.64 (1,071.91)	3,360.76 (891.03)	3,367.80 (1,382.63)
Federal Grants	2,738.94 (572.57)	2,631.53 (753.20)	2,817.47 (801.02)	2,961.09 (704.00)	2,633.56 (750.34)
Institutional Grants	272.68 (141.37)	268.25 (459.91)	362.31 (542.15)	397.99 (550.95)	268.33 (455.96)
Institutions	11	752	261	156	763

Source: IPEDS; 2014-15 (pre-treatment).

Notes: Table presents means and standard deviations (in parentheses), weighted by institutions' financial aid cohort size; Figures rounded; Nation includes all other institutions in the United States; SREB includes institutions in the Southern Regional Education Board member area; Contiguous includes institutions in states geographically adjacent to Tennessee; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates.

Table A3. *Outcome trends for Tennessee community colleges.*

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Percent Borrowing	16.91	20.00	23.09	28.82	25.82	25.09	21.18	17.09	9.00	9.82	7.55
Average Loan	614.00	857.12	1043.92	1117.30	1152.66	1159.80	972.62	775.65	402.67	412.48	324.02

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table presents means; Figures rounded; Percent borrowing is of FTFT DS UG financial aid cohort; Average loan is in dollars (\$), adjusted for inflation (2018 CPI), and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Tennessee Promise began in 2015-16.

Table A4. *Mean differences.*

Percent Borrowing	Pre	Post	Difference
Tennessee (<i>n</i> =11)	22.31	8.62	-13.69
Nation (<i>n</i> =752)	25.06	21.54	-3.52
Difference	-2.75	-12.92	-10.17
SREB (<i>n</i> =261)	23.36	23.49	0.13
Difference	-1.05	-14.87	-13.82
Contiguous (<i>n</i> =156)	22.09	20.66	-1.43
Difference	0.22	-12.04	-12.26

Average Loan	Pre	Post	Difference
Tennessee (<i>n</i> =11)	988.58	382.53	-606.05
Nation (<i>n</i> =752)	1245.50	1024.49	-221.01
Difference	-256.92	-641.96	-385.04
SREB (<i>n</i> =261)	1151.95	1074.46	-77.49
Difference	-163.37	-691.93	-528.56
Contiguous (<i>n</i> =156)	1059.97	918.50	-141.47
Difference	-71.39	-535.97	-464.58

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table presents means and treat-control differences; Pre defined as 2007-08 to 2014-15, Post as 2015-16 to 2017-18; Figures rounded; Average loan is in dollars (\$), adjusted for inflation (2018 CPI), and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Unconditional difference-in-differences estimates bolded.

Table A5. Robustness: Non-promise state counterfactual.

	Percent Borrowing		Average Loan	
	Binary	Dosage	Binary	Dosage
Promise	-9.49*** (0.78)	-9.03*** -0.13 (0.01)	-318.48*** (54.33)	-289.66*** -4.23 (0.77)
Percent Black	0.34** (0.12)	0.34** (0.12)	24.59** (7.99)	24.62** (7.98)
Percent Hispanic	-0.14* (0.06)	-0.14* (0.06)	-8.03* (3.52)	-8.03* (3.53)
Percent Over 25	0.28*** (0.06)	0.28*** (0.06)	19.66*** (4.36)	19.68*** (4.36)
Tuition and Fees	0.13 (0.08)	0.13 (0.08)	9.72* (4.55)	9.73* (4.55)
Federal Grants	0.53*** (0.08)	0.53*** (0.08)	35.13*** (4.48)	35.15*** (4.48)
Institutional Grants	-0.15 (0.12)	-0.15 (0.12)	-7.91 (5.84)	-7.77 (5.82)
Adj. R^2	0.864	0.864	0.851	0.851
Observations	7,689		7,689	
Year Fixed Effects	Y		Y	
Institution Fixed Effects	Y		Y	

⁺ $p \leq .10$ * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table reports coefficients and robust standard errors (in parentheses, clustered by state); Figures rounded; Each specification is weighted by institutions' FTFT DS UG financial aid cohort; Counterfactual includes public, two-year institutions in all states except Delaware, Kentucky, Minnesota, Oregon, Rhode Island; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Binary columns represent traditional (1,0) DID treatment specifications; For Dosage columns: Promise Enrollment is the proportion of the financial aid cohort who are eligible to receive Promise scholarship money; For the first row of Dosage (Promise): The leading figure estimates the effect of increasing the mean proportion eligible by 68.54 percentage points ($\beta * 68.54$, the mean change in enrollment from pre- to post-Promise) on the outcome, and the second is the estimated coefficient for a 1-percentage point change in Promise-eligible enrollment on the outcome; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates; Tuition and fees, federal grants, and institutional grants scaled by \$100.

Table A6. Sensitivity: Institution-specific linear time trend.

	Percent Borrowing			Average Loan		
	Nation	SREB	Contiguous	Nation	SREB	Contiguous
Promise (DID)	-5.53*** (0.86)	-5.17*** (1.08)	-6.47*** (1.19)	-118.65 ⁺ (61.71)	-116.72 (71.44)	-233.46* (70.68)
Percent Black	0.25* (0.10)	0.18 (0.12)	0.024* (0.09)	17.06* (7.99)	13.32 (12.07)	22.61* (8.89)
Percent Hispanic	-0.15 ⁺ (0.09)	0.08 (0.12)	-0.30 (0.39)	-3.20 (4.04)	4.56 (12.21)	-13.94 (14.69)
Percent Over 25	0.37*** (0.08)	0.14 (0.10)	0.15 (0.11)	30.52*** (6.41)	13.39* (5.63)	13.11 ⁺ (6.59)
Tuition and Fees	0.07 (0.10)	0.08 (0.11)	-0.02 (0.16)	8.98 (6.07)	7.64 (7.04)	0.97 (8.93)
Federal Grants	0.52*** (0.10)	0.35*** (0.08)	0.28* (0.10)	37.10*** (5.46)	30.08*** (6.55)	17.77** (4.99)
Institutional Grants	-0.30** (0.11)	-0.19 (0.11)	-0.28 ⁺ (0.13)	-13.51* (5.79)	-7.58 (6.12)	-16.34*** (2.97)
Adj. R^2	0.907	0.837	0.825	0.896	0.808	0.800
Observations	8,393	2,992	1,837	8,393	2,992	1,837
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Institution Fixed Effects	Y	Y	Y	Y	Y	Y

⁺ $p \leq .10$ * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

Source: IPEDS; 2007-08 through 2017-18.

Notes: Table reports coefficients and robust standard errors (in parentheses, clustered by state); Figures rounded; Each specification is weighted by institutions' FTFT DS UG financial aid cohort and include an institution-specific linear time trend defined as interaction between each unit and year covering the panel horizon; Nation includes all other institutions in the United States; SREB includes institutions in the Southern Regional Education Board member area; Contiguous includes institutions in states geographically adjacent to Tennessee; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates; Tuition and fees, federal grants, and institutional grants scaled by \$100.

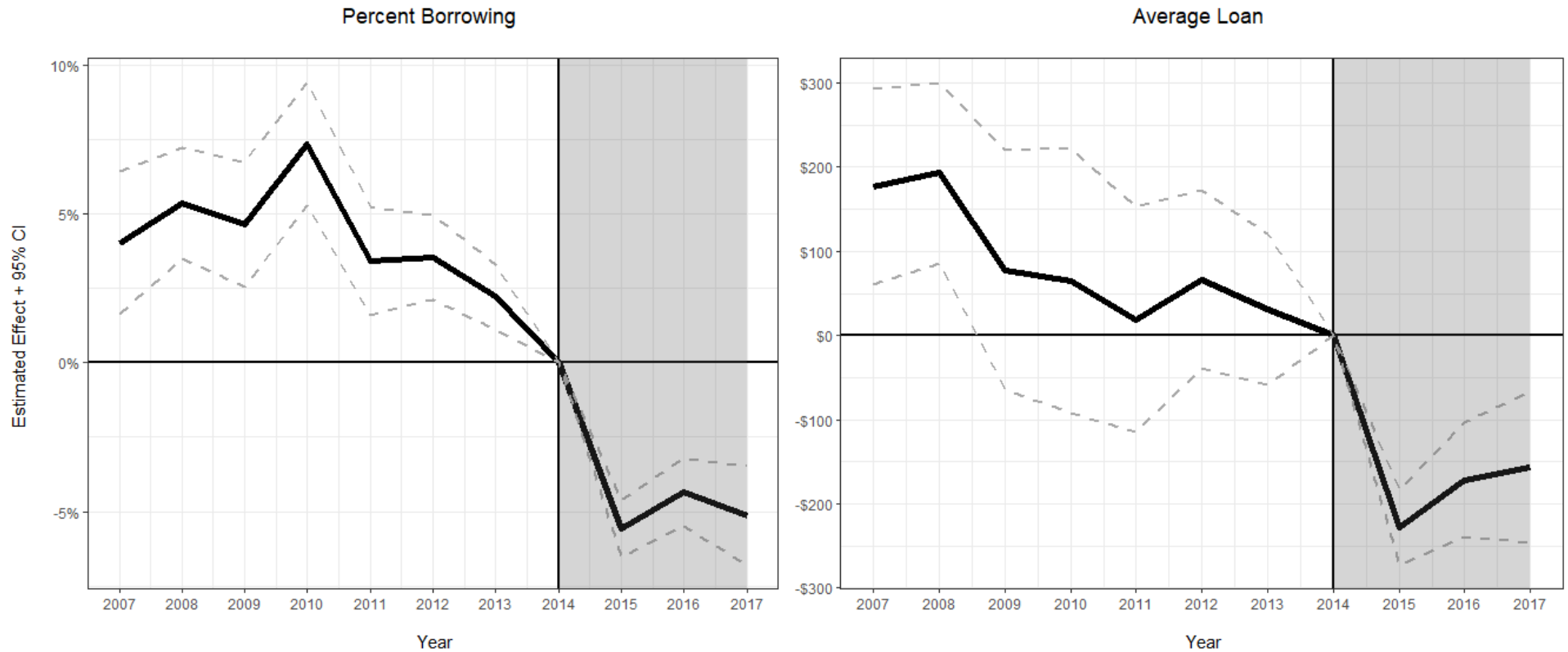
Table A7. Sensitivity: Lagged dependent variables.

	Percent Borrowing		Average Loan	
	Binary	Dosage	Binary	Dosage
Promise	-4.84*** (0.28)	-4.47*** -0.07 (0.00)	-228.67*** (24.16)	-213.42*** -3.11 (0.32)
Percent Black	-0.02 (0.02)	-0.02 (0.02)	-1.60 ⁺ (0.94)	-1.63 ⁺ (0.93)
Percent Hispanic	-0.06*** (0.02)	-0.06*** (0.02)	-2.71*** (0.81)	-2.74*** (0.81)
Percent Over 25	-0.01 (0.03)	-0.01 (0.03)	-1.44 (1.32)	-1.46 (1.32)
Tuition and Fees	0.04* (0.02)	0.04* (0.02)	2.54* (1.14)	2.55* (1.14)
Federal Grants	0.10*** (0.02)	0.10*** (0.02)	6.10*** (1.25)	6.13*** (1.24)
Institutional Grants	-0.00 (0.03)	-0.00 (0.03)	-1.21 (1.59)	-1.24 (1.60)
Dependent Variable Lag ($Y_{i,t-1}$)	0.89*** (0.01)	0.89*** (0.01)	0.90*** (0.01)	0.90*** (0.01)
Adj. R^2	0.876	0.876	0.870	0.870
Observations	7,630		7,630	
Year Fixed Effects	Y		Y	
Institution Fixed Effects	N		N	

⁺ $p \leq .10$ * $p \leq .05$, ** $p \leq .01$ *** $p \leq .001$

Source: IPEDS; 2008-09 through 2017-18.

Notes: Table reports coefficients and robust standard errors (in parentheses, clustered by state); Figures rounded; Each specification is weighted by institutions' FTFT DS UG financial aid cohort and includes a 1-year lagged dependent variable; Counterfactual includes all other public, two-year institutions in the nation; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan and grants are in dollars (\$) and computed from total amount over FTFT DS UG financial aid cohort; Loans include any source; Binary columns represent traditional (1,0) DID treatment specifications; For Dosage columns: Promise Enrollment is the proportion of the financial aid cohort who are eligible to receive Promise scholarship money; For the first row of Dosage (Promise): The leading figure estimates the effect of increasing the mean proportion eligible by 68.54 percentage points ($\beta * 68.54$, the mean change in enrollment from pre- to post-Promise) on the outcome, and the second is the estimated coefficient for a 1-percentage point change in Promise-eligible enrollment on the outcome; Average loan and finance variables adjusted for inflation (2018 CPI); Demographics are proportions of UG enrollment; Tuition and fees are in-state, UG rates; Tuition and fees, federal grants, and institutional grants scaled by \$100.

Figure A1. *Event study plots.*

Source: IPEDS; 2007-08 through 2017-18.

Notes: Plots show event-study design estimates and 95% confidence intervals for each year estimate from Equation A1 comparing Tennessee community colleges' mean outcomes to the national counterfactual group, omitting the year immediately prior to Tennessee Promise (2014-15) as reference; 2014 identifies academic year 2014-15, and shading identifies the post-treatment period; Percent borrowing is proportion of FTFT UGs who borrowed from any loan program; Average loan is in dollars (\$), computed from total amount over FTFT DS UG financial aid cohort, and adjusted for inflation (2018 CPI); Loans include any source.